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Business Model Based Concept Generation

Understanding, creating and managing concepts in business

Thesis submitted in partial fulfillment of the requirements for the degree of Licentiate of Science (Technology).

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Abstract

This study introduces a new approach called Business Model Based Concept Generation. Concept development in the business environment has been analyzed in the six academic papers included in this thesis. The main task has been to understand what concept development and design means in theory and in practice, and how companies actually develop new concepts in their innovation activities. In this study, Finnish manufacturing companies have been involved widely, ranging from a micro-size enterprise from the northern Lapland to a large, globally operating company in southern Finland.

This study found that many companies are extremely product oriented. Concept development does not cover the whole business and much innovation potential is lost when concentrating on tangible products. Companies are familiar with service innovations, but service concept creation is still problematic for the manufacturing companies. On the other hand, an innovation system is not that developed in the companies that produce services. Furthermore, innovation activities rarely reach all the business units, but innovations are seen as part of product development initiatives. In practice, in an average company there are no multidisciplinary teams developing different types of innovations. As a result, companies do not understand the meaning and significance of concepts and concept development, they lack the knowledge, processes and methods for conscious concept generation and concept development. Front-end innovation is so to say unstructured and unmanaged.

Companies manage to create successful solutions, but often especially in small companies, the success results from evolutionary development activities by an entrepreneur, not goal-oriented innovation work. Companies are seldom able to recognize the key to success; they have no ability to understand the concept of successful solution. Product-oriented focus in thinking and operations prevent developers and managers from seeing innovations and innovation potential in other dimensions of business. It would help if the concept could be seen as a recipe for ways in which something is made and served. Then the breakthrough solution could be replicated, scaled, varied or applied innovatively, if the concept was clear for the developers. *As a summary, the Business Model Based Concept Generation approach would help companies to develop many types of innovations consciously and renew the early phases of product development; an innovative business model should influence product (service) design and vice versa.*

Keywords Concept generation, front-end innovation, product development, design

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Tiivistelmä

Lisensiaatintutkielmassa esitellään innovaatioprosessin alkupäähän uusi lähestymistapa nimeltä Business Model Based Concept Generation (Bisnesmallipohjainen konseptointi). Konseptien luomista ja kehittämistä analysoidaan kuudessa akateemisessa julkaisussa, jotka ovat osa tutkielmaa. Keskeinen tavoite oli avata konseptointia sekä teoreettisesti että käytännönläheisesti tutkimalla innovaatioprosessin alkupään käytäntöjä valmistavassa teollisuudessa Suomessa. Tavoitteena oli selvittää, kuinka yritykset kehittävät uusia konsepteja ja millaisia ne käytännössä ovat. Lukuisia eri alojen yrityksiä on liitetty tutkimukseen eri puolilta maata; yritysten joukossa on mikro- ja PK-yrityksiä aina Lappia myöten sekä globaalisti toimivia suuryrityksiä eri puolilta Suomea.

Tutkimuksessa havaittiin, että monien yritysten innovaatiotoiminta on erittäin tuoteorientoitunutta, jolloin konseptointia ei uloteta koko liiketoimintaan eikä siihen kytketä mukaan yrityksen sekä verkoston poikkitieteellisiä toimijoita. Innovaatiopotentiaalia hukataan, kun keskitytään liiaksi aineellisiin tuotteisiin eikä havaita mahdollisuuksia muun tyyppisissä innovaatioissa. Innovaatiotoiminta pohjautuu monissa yrityksissä tuotekehitykseen, mikä luonnollisesti ohjaa kehittämisen fokusta. Useimmissa yrityksissä konseptien luominen ja kehittäminen eivät ole riittävän tietoista ja laaja-alaista, jotta syntyisi monen tyyppisiä innovaatioita liiketoiminnan eri osa-alueille; konseptivaihe on toisin sanoen huonosti organisoitu ja johdettu. Esimerkiksi palvelu-, kumppanuus- ja ansaintamalli-innovaatiot jäävät usein huomaamatta.

Yrityksissä toki synnytetään menestyviä ratkaisuja, mutta eritoten pienissä yrityksissä ratkaisut kehittyvät vähitellen evolutiivisesti eivätkä suinkaan tavoitteellisen innovaatiotyön tuloksena. Harva tutkittavista yrityksistä myöskään kykeni tunnistamaan erilaisten konseptien menestystekijöitä, mikä olisi olennainen osa tietoista menestyskonseptien rakentamista. Jos konsepti nähtäisiin ikään kuin reseptinä, kuinka jokin ratkaisu toteutetaan ja tuotetaan, olisi menestyviä ratkaisuja helpompi monistaa, skaalata, muunnella ja soveltaa. Tuotteiden kehittämiseen keskittyminen käytännössä estää muunlaisten innovaatioiden synnyn, joten uusi lähestymistapa on tarpeen innovaatioprosessin alkupäähän. *Business Model Based Concept Generation (Bisnesmallipohjainen konseptointi) auttaa yrityksiä kehittämään monen tyyppisiä innovaatioita tietoisesti sekä pääsemään irti tuotekeskeisyydestä. Uuden lähestymistavan myötä tuote- ja palvelukehitys ottavat paremmin huomioon koko liiketoimintamallin.*

Avainsanat Konseptisuunnittelu, innovaatioprosessin alkupää, tuotekehitys, muotoilu

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List of Publications

Paper I: Sääskilahti, M. (2013). "Concept Thinking", Journal of International Business and Cultural Studies, vol. 7

Paper II: Sääskilahti, M. (2012). "Levels of Concept Development", Food Innovation Asia Conference, "Green and Sustainable Food Technology for All", Bangkok, Thailand

Paper III: Sääskilahti M., Jaakkola E., Alakärppä I. and Valtonen A. (2008). "Concept Innovation – new approach for creating innovations at a conceptual level", ISPIM Innovation Management Symposium, Singapore

Paper IV: Sääskilahti M. and Nuutinen M. (2010). "Collaborative Concept Development in Creating B-to-B Service Innovations", 3rd ISPIM Innovation Symposium, Quebec, Canada

Paper V: Sääskilahti M. (2010). "Innovative Concept Development in the Food Industry", 1st international conference on Trends and Challenges in Food Technology, nutrition, hospitality and tourism, Ljubljana, Slovenia

Paper VI: Sääskilahti M. (2015). "GoldMine Concept Lab: An Environment for Early Phase Concept Creation and Prototyping", Mediterranean Conference on Information & Communication Technologies MedICT'2015, Saïdia, Morocco

1 Introduction

In competitive business environments, innovation is widely conceived as a key driver of corporate success. However, the low innovation success rates indicate that innovation is in fact a very challenging enterprise (Ahmed, 1998). This background encourages finding more systematic approaches to achieve innovations. Innovations are typically comprehended as a result of initiatives related to product and service development (Kim and Wilemon, 2002). On the other hand, Keeley expanded the scope to handle the entire business, and created an innovation classification called Ten Types of Innovation (Keeley et al., 2013). In practice, this means that the innovation can emerge from any aspect of the business, not merely technology and product development. He introduces ten different innovation types with four main groups: finance, process, offering and delivery. This classification offers the backbone of this study, against which the findings from the study are reflected.

Concept creation, selection and definition are typical actions during the product development process (Ulrich and Eppinger, 2008). Concept development is seen as the most critical phase of a product innovation process (Orihata and Watanabe, 2000). Traditionally, it has been connected to product development activities and lately also to service development (Khurana and Rosenthal, 1998; Alam, 2006; Kim and Wilemon, 2002). Systematic concept development is often viewed as a tool for reducing the fuzziness of the early stages of a development process (Alam, 2006). In this work, the idea of concept creation is extended from product development to business development; the goal of an innovation activity and concept development can be targeted to products, services and product service systems (Otto and Wood 2001; Cagan and Vogel 2002; Sakao and Lindahl, 2009) but it can also cover the whole business model (Osterwalder and Pigneur, 2010; Keeley et al., 2013). In concept creation, the user and customer experience may be regarded as important, but moreover, for example an innovative profit model or delivery system can be crucial in particular cases. Further, if a new delivery solution is driving development work, it may have tremendous influence on new product and service design. This is why a holistic approach is needed in front-end innovation (Alam, 2006).

Innovation activities and product (service) development involve expertise from most of the corporate functions; in addition to engineering and design, there are experts from sales and marketing, manufacturing, management and so forth (Otto and Wood 2001; Ulrich and Eppinger, 2008). Anyhow, the product development process and product development teams are tuned to develop products. This study concludes that companies are focused on products and product development, losing a great variety of innovation opportunities. In this study, an approach called Business Model Based Concept Generation is introduced to highlight the opportunities the companies have in their numerous functions and operations. Design Thinking is presently applied widely within industry and businesses (Meinel and Leifer, 2010), but a holistic concept generation and Concept Thinking are not adopted properly yet (Sääskilahti, 2013). This study explores and discusses concept generation and Concept Thinking.

1.1 Outline of the Study and Author Contribution

This work consists of six papers and a synthesis part. Five conference papers and one journal article can be found at the end of this study; a summary of the papers is included in the introductory part. After the introduction to concepts, concept creation and concept management, Chapter two presents a theoretical background based on design, development and innovation literature. The aim of the theory section is not to provide a complete literature review of all the existing knowledge in front-end innovation theories, methodologies and processes, but to highlight the interface between design, development and innovation activities in business. Chapter three presents the research problem and objectives of the study as well as the data collection procedure behind the papers.

Chapter four conveys the main results of the articles: first, the mindset called Concept Thinking is introduced; second, the three levels of concept development are presented including product, service and business levels. Third, a notion called Concept Innovation is elaborated, illustrating how innovations can be investigated before actual development and realization. The next two papers introduce, Collaborative Concept Development, a new approach to front-end innovation, and discuss innovative concept development in the food industry. In

the last paper, the idea of Business Model Based Concept Generation is depicted. The final chapter presents the main contributions to research and practice and discusses the main findings, limitations and future work.

The first of the six academic publications included in this study (Paper I), "Concept Thinking", written solely by Mikko Sääskilahti (100%), was published in the Journal of International Business and Cultural Studies 2013, vol. 7. The second paper (Paper II), "Levels of Concept Development", was presented in Food Innovation Asia Conference, "Green and Sustainable Food Technology for All", in Bangkok, Thailand 2012. Sääskilahti (100%) was the only author of this paper too. The third paper (Paper III), "Concept Innovation – new approach for creating innovations at a conceptual level", was presented in ISPIM Innovation Management Symposium, Singapore 2008. This paper was written by Mikko Sääskilahti (50%), Elisa Jaakkola 25%, Ismo Alakärppä (25%) and Anu Valtonen (10%). The fourth paper (Paper IV) was co-written with Maaria Nuutinen (40%). This paper, "Collaborative Concept Development in Creating B-to-B Service Innovations", 2010, was presented in 3rd ISPIM Innovation Symposium, Quebec, Canada. The fifth paper (Paper V), "Innovative Concept Development in the Food Industry", 2010, was presented in the 1st international conference on Trends and Challenges in Food Technology, nutrition, hospitality and tourism, Slovenia. Mikko Sääskilahti (100%) wrote this paper individually. The sixth paper (Paper VI), "GoldMine Concept Lab: An Environment for Early Phase Concept Creation and Prototyping", 2015, is presented in Mediterranean Conference on Information & Communication Technologies MedICT'2015, Saïdia, Morocco. Mikko Sääskilahti (100%) wrote this paper individually.

2 Theoretical Framework

2.1 Concept creation, design and development

In this work, concept development is reflected against the system of business model generation. First, it is important to clarify what the notions of concept and concept development mean. Concept as "a concept" is difficult both to academics and practitioners; does it have different meanings to different professionals in different businesses? The problem is that we think that concept in itself is an object, but actually it explains an object or thing. In design, the development and innovation work concept of something that is first created, defined and often illustrated, and then the outcome is further developed and later produced, launched and delivered to the market, in a way guided by the concept. In the context of product development, the term concept is used as such, without modification, although it should be defined more accurately, e.g. product concept. This is because so many kinds of concepts can be coined: service concept, manufacturing concept, teamwork concept, event concept, space concept, cooperation concept etc. The notion "concept creation" describes that a new concept is developed, but additional descriptions should be added to define the focus precisely, i.e. concept of a product (product concept), concept of a service (service concept) or concept of an event (event concept).

In addition, concept can be seen as a recipe for how something is made; a recipe lists what something is made of, and how is it made and offered. A concept can also be scaled, varied and applied. As an example, the concept of a mass product indicates that it is a product for certain use belonging to a certain product family, and it is replicated (manufactured) e.g. ten thousand times. The concept of haircut service defines how customers are treated one after another, e.g. ten times per day. The concept of fast food restaurant tells how the entire restaurant is replicated to another location, one by one. The Olympic Games are organized every fourth year following an exact concept. In concept creation, it is essential to understand how simple and small or complex and large is the thing what is developed and later replicated, is it to be replicated often or seldom, as such or with variations. It is a question of scaling the business, and it can be scaled without changes, in a

"Catholic way", or with adjustments, in a "Buddhist way" (Sutton and Rao, 2014). In concept creation and development, it is crucial to carefully define the concept of what which is actually in focus.

As described earlier, concept is like a recipe, describing an idea, how it is made and of which elements, and how it is produced and replicated. However, it may still be confusing because there are concept cars in car shows, future concepts in business visions (Sääskilahti, 2005), concept artists working in game and animation studios, service concepts in an offering of a company, concepts of a new products on a drawing desk of a designer, to name a few. A concept always expresses something, e.g. the concept of car describes the future car, which could be manufactured in the future. A concept artist is drafting the new game, so s/he is defining a concept of a new game or animation (later the game or animation will be produced by following this earlier defined concept). In certain businesses, services are well defined, e.g. in fashion, retail and restaurant operations, and in these cases it actually means that the service is replicated following its carefully defined concept, concept of a service, in other words service concept. In product and service design, a new product, service or product-service system is shaped in early phases of the development process, and the forthcoming product or service is defined by forming a concept.

To completely understand the meaning of concepts, the time dimension must also be explained related to concepts, concept creation and management, see Figure 1 below. All phenomena have their conceptual counterparts as explanations: products and services are produced and delivered as their concepts define. For example, a concept of a good team might be identified and teams are built by following this concept. Events and seminars are arranged frequently with certain concept in mind. In the Figure 1 on the first level (1) there are concepts of the things in the current business. These things and their concepts are naturally defined in the past. (Of course there are many things which have developed in an unconscious and evolutionary manner, but also in these cases a certain underlying concept can be found.) On the second level (2), there is the so-called innovation funnel where new things are developed, and these things are launched as defined by their concepts. On this level, also concepts of new products can be found related to new product development (NPD) (Cagan and Vogel, 2002). The third level (3) actually represents the roadmap for what will emerge in the future.

On this level, future solutions are sketched and a route via innovation process to the business is drafted. For example, car and electronics manufacturers often introduce future concepts that are actually predecessors or concepts of future solutions, (e.g. concept car). In practice, some ideas never materialize in reality, meaning that the concept of something remains on a so-called conceptual stage (Keinonen and Takala, 2006).

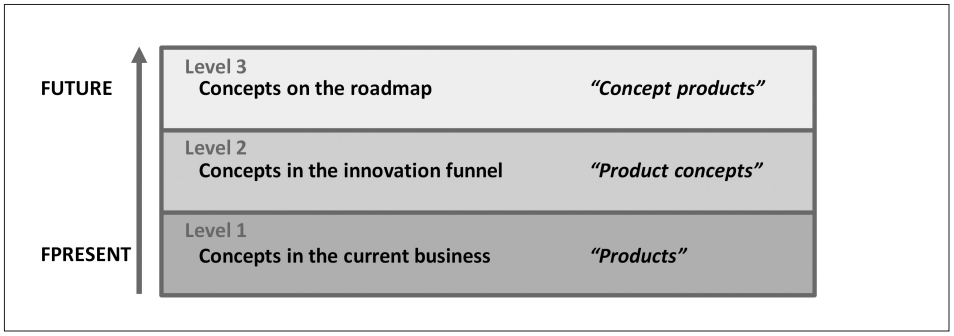

Figure 1 – Time frame of concepts and position in business

This work argues that concept creation can be seen as a cornerstone in building innovations. First of all, in the process from idea to concept, there is room for ideas from everybody in the stakeholder map, and secondly, concept creation is an important phase where the entity is shaped (Alam, 2006). As product developers and project managers know, later in the process new ideas and changes are difficult and costly (Otto and Wood, 2001). In other words, concept creation is for co-creation involving designers and developers, managers, marketers, manufacturers, users, clients, partners, dealers, among others. On the other hand, a concept is a holistic and solid picture of something to be developed (or existing). Concept is like an ecosystem; functions and features form an interactive system which can be studied as a unique entity, but on the other hand, this ecosystem has an interface to surrounding (eco) systems. In concept creation, one of the key points is to decide what to include in and what to exclude from a certain concept – this naturally defines also the complexity of a forthcoming solution and project, and the resources required by the case.

2.2 Design, development and innovation in business

The roots of this study are in product development and industrial design. Industrial design is namely design for industry (Loewy, 1988). Industrial Designers Society of America (IDSA) defines industrial design as "the professional service of creating products and systems that optimize function, value and appearance for the mutual benefit of both user and manufacturer". The definition continues: "Industrial designers develop products and systems through collection analysis and synthesis of data guided by the special requirements of their client and manufacturer. They prepare clear and concise recommendations through drawings, models, and descriptions. Industrial designers improve as well as create, and they often work within multi-disciplinary groups that include management, marketing, engineering and manufacturing specialists". Industrial design is a natural element of product development, and the significance of industrial design depends on the project; in some type of industrial equipment development the cost (need) of industrial design is low whilst a product such as an automobile requires industrial design effort worth millions of dollars (Ulrich and Eppinger, 2008).

"A product development process is the entire set of activities required to bring a new concept to a state of market readiness" (Otto and Wood, 2001). Product development includes e.g. a new product vision, business case analysis, marketing efforts, technical engineering design and manufacturing activities, and the validation of the product design. Otto and Wood further argue that a design process is the set of technical activities within a product development process. Design process activities strive to meet the marketing and business case vision. "The Research and Development (R&D) phase of new product development is when new technology is developed for subsequent incorporation into products" (Otto and Wood, 2001). Furthermore, according to Otto and Wood, large companies in many industries try to separate the R&D process from the product development process to keep product development as a rapid process. Otto and Wood (2001) classify the design process by disciplines, e.g. mechanical engineering design, electrical engineering design, architectural design, industrial design, food science design, furniture design, materials design, aerospace design. In other words, there is a design process for any product. According to Otto and Wood, engineering design is a process that requires modeling to complete the design task (while the craftsmanship approach is intuitive).

In product development, a product can be tangible (product) or intangible (service) (Otto and Wood, 2001; Cagan and Vogel, 2002), presently often a combination of product(s) and service(s), i.e. a product-service system (PSS) (Sakao and Lindahl, 2009). In the past, product development most often meant developing physical products, but currently services and service industry play a significant role in business. The role of service design has increased significantly and it is no longer hidden behind the product design and development terminology but service design is rather seen as a new and unique discipline (Meroni and Sangiorgi, 2011; Miettinen and Valtonen, 2012).

Innovation and Front-end innovation (FEI) as well as concept development and design constitute key words in this study and therefore important areas in the theoretical framework. Innovation is also a mantra in business language, a vital goal for all companies. According to business dictionary (www.businessdictionary.com), innovation is defined as: "The process of translating an idea or invention into a good or service that creates value or for which customers will pay. To be called an innovation, an idea must be replicable at an economical cost and it must satisfy a specific need. Innovation involves deliberate application of information, imagination and initiative in deriving greater or different value from resources, and it includes all processes by which new ideas are generated and converted into useful products. In business, innovation often results when ideas are applied by the company in order to further satisfy the needs and expectations of the customers. In a social context, innovation helps create new methods for alliance creation, joint venturing, flexible work hours, and creation of buyers' purchasing power. Innovations are divided into two broad categories: 1) Evolutionary innovations (continuous or dynamic evolutionary innovation) that are brought about by many incremental advances in technology or processes and 2) revolutionary innovations (also called discontinuous innovations) which are often disruptive and new."

Front-end innovation covers all the actions that are taken between the first consideration of an opportunity and the decision whether to start product development (Kim and Wilemon, 2002). Concept development and concept design are part of the front-end innovation process. Keinonen and Takala (eds.) (2006) list five directions to concept generation activity: 1) product development, 2) innovation, 3) shared vision, 4) competence and 5) expectation management (Keinonen and Takala, 2006). In concept design, the aim is to define the design

challenge and map the alternatives. Also Otto and Wood (2001) highlight the importance of the amount of ideas and concept variants in concept generation. Keinonen and Takala (2006) also claim that "the aim of concepting is to prepare for concurrent engineering by specifying the fundamental solution to the design problem, which is used as the basis for the decision to go ahead with detailed design". Concept development is usually seen as a critical component of the product (service) development process because of its strategic nature – guidelines for the subsequent development process are given during the concept phase (Alam, 2006; Kim and Wilemon, 2002; Khurana and Rosenthal, 1998).

Concept design for innovation is a tool for looking further into the future than to mere product design – design can develop what technology allows into concrete and specific proposals. Concept design for innovation should not be mixed with goal-oriented and time-critical product development projects. Changes in the business environment require decisions about the offering to be made continuously. Decisions are made by a large group of different players from different business units; the concept design approach is usable when sharing the vision. The conceptualization of new products makes the alternatives more tangible. Concept design for competence helps companies to grow expertise and maintain their innovation potential whereas routine product design may not offer enough opportunities to challenge one's expertise. Permission to fail is also needed during an individual's learning process. Concepting is an ideal framework for learning about new technologies and business opportunities. Finally, concept design can be applied for expectation management. Companies can control the expectations of the general public through communication. People can e.g. be prepared for new products by showcasing them in public before the actual product launch, exactly as they do in automotive industry by bringing concept cars to car shows. (Keinonen and Takala, 2006).

From the perspective of designers and surely also company representatives or clients, the relationship between differently named design, development and innovation activities is confusing. Figure 2 "Design, development and innovation in business" illustrated the theoretical framework of this study. Design, development and innovation activities are here seen in the light of business and industry, while other points of view have been excluded (e.g. operations and processes in non-profit organizations or, for example, attempts for social innovations). However,

the background of the figure below represents business itself and, on the other hand, business functions, such as management, marketing and manufacturing. Innovation work and product (service) development involve expertise from most of the functions from the company (Otto and Wood 2001; Ulrich and Eppinger, 2008). Front-end innovation, including concept development, traverses the entire business and, on the other hand, organization and even stakeholder groups. Applied from Otto and Wood (2001), product (service) design is illustrated as part of product (service) development, as well as engineering design and industrial design. The backbone of the business is R&D, relating strongly to the front-end innovation. Back-end innovation is placed beside product development and engineering design.

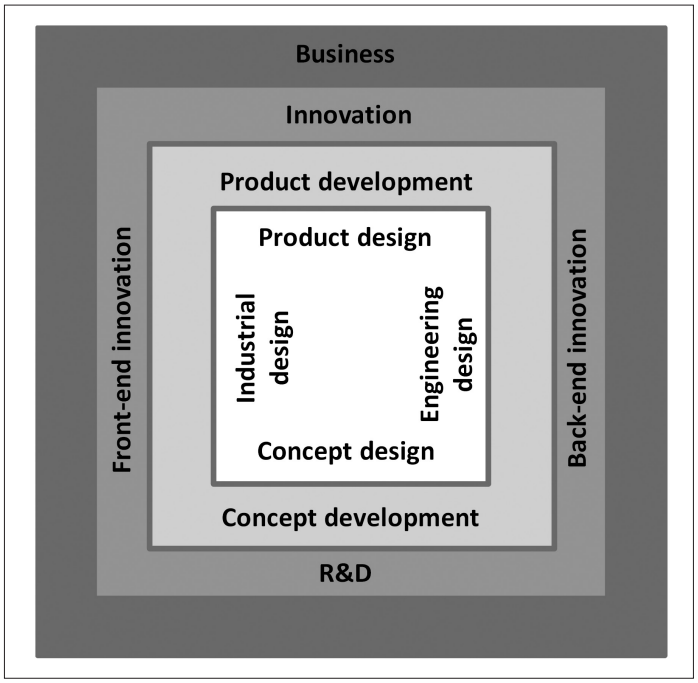

Figure 2 – Design development and innovation in business

2.3 Systems Thinking, Business Model Generation and Ten Types of Innovation

Business Model Based Concept Generation requires a wide perspective to innovation work. Systems Thinking can be seen as an essential element of the theoretical framework, because in Business Model Based Concept Generation the idea is to draw a big picture, identify the structure of the system/concept and

understand the interactions between the entities. "A system is an interconnected set of elements that is coherently organized in a way that achieves something" (Meadows, 2008). The system consists of three kind of things: a) elements, b) interconnections, and c) a function or purpose. For example, the elements of a digestive system include teeth, enzymes, stomach, and intestines; the function of this system is to break down food into its basic nutrients and transfer these nutrients into the bloodstream, which is another system. A school is a system, as well as a city, factory, corporation, or a national economy. An animal or a tree is a system; a forest is a larger system that encompasses subsystems of trees and animals. Systems can be embedded in systems, which are embedded yet in other systems, e.g. tree-forest-earth-galaxy. (Meadows, 2008).

Systems thinking is adopted in problem solving to consider problems in their entirety (Rubenstein-Montano, 2001). The outcomes from systems thinking depend on how a system is defined and what kind of relationships there actually are. When thinking in terms of systems, boundaries must be set to understand what parts of the world are contained inside the system and what parts are considered the environment of the system. Systems (concepts) can also overlap with each other (Rubenstein-Montano, 2001). According to Meadows (2008), the elements in a system can be either tangible or intangible, with possible sub-elements, sub-sub-elements and so forth. For example, a university comprises buildings, students, professors, libraries, and books (tangible), but also requirements for degrees, examinations, grades, budgets and gossips (intangible) – and of course communication of the knowledge, which is the purpose of the whole system. The relationships that hold the elements are called interconnections, all essential for the system, because they all have their contributing roles. "But the least obvious part of the system, its function or purpose, is often the most crucial determinant of the system's behavior" (Meadows, 2001). "The least obvious part of the system" is interesting from the point of view of innovation. Complex concepts are difficult to create and copy, because there are intangible elements, numerous interconnections and other components, often insignificant looking, that are difficult to notice, but that have an essential role in the system. Concept design is actually systems design – typically the target of design is more a system with elements, sub-elements and interconnections, rather than a unique, independent object.

Concept development involves expertise from the whole company or even the stakeholder network. This is the reason why understanding business models can be seen as essential in the concept creation phase. The Business Model Generation approach and business model canvas introduced by Osterwalder and Pigneur (2010) have been applied as a source of inspiration and information in the development of the Business Model Based Concept Generation approach (Osterwalder and Pigneur, 2010). Canvas consists of nine segments: key partners, key activities, key resources, value propositions, customer relationships, channels, customer segments, cost structure and revenue streams. Similarly, in Ten Types of Innovation introduced by Keeley et al. (2013), business is divided into more focused areas that can be designed innovatively. The ten types of innovation are profit model innovation, network innovation, structure innovation, process innovation, product performance innovation, product system innovation, service innovation, channel innovation, brand innovation and customer engagement innovation. The main idea is that not only products or services can be innovative but the whole business can be constructed innovatively. For example, the delivery channel or brand innovation will definitely influence the product or service, which is crucial from the point of view of designers. All in all, concept development is a point where the whole business model can be discovered and an input to product and service design given.

3 Research Approach and Methodology

This study was conducted over several years between 2008 and 2015. During this period, 39 companies have been discovered, mostly micro-, small- or medium-size enterprises. The objectives of this study are presented in this chapter. Also the collection of empirical data analyzed in the original papers is described, as well as the research methodology.

3.1 Objectives of the Study

Front-end innovation and concept creation are often described as "fuzzy" because of the unstructured nature of front-end process (Khurana and Rosenthal, 1997). In practice, the reason is perhaps the lack of knowledge and understanding –the related literature fails to comprehensively explain what concept means in the context of business and innovation and how to deal with concepts in the business environment. The objective of this study is to find out what kind of concepts companies develop and how. Another purpose of the study is to show the potential companies have related to concept creation and management. This work is aimed both for academics and practitioners to help understand the "world of concepts". The goal of this study has been to comprehend in which role concepts and concept creation are in companies, and to draw a picture of the topic to serve individuals, teams and companies in multidisciplinary business environments.

The primary research question is formulated to answer the question of how companies actually realize the front-end process, and what they focus on along the process. One of the main interests was to examine if companies have a holistic approach to front-end innovation, or if the mindset is typically product- and technically oriented. Generally, the role of concept creation in the innovation process was investigated, as well as whether new concepts are developed consciously.

> *Q1: What kind of concepts do manufacturing companies develop during the front-end innovation phase (FEI)?*

The secondary research question seeks answers to what kind of potential concept creation yields in companies and organizations. Findings from interviews and observations have been transformed to new, more efficient and innovate models and approaches to concept creation and development. Support is given by the latest innovation literature, in which the innovative business model is in the center of innovation work (Osterwalder and Pigneur, 2010; Keeley et al., 2013).

Q2: How could the innovation performance be enhanced during the concept development phase?

A holistic concept creation approach called Business Model Based Concept Generation is formulated and presented in this work; the papers included focus on a common topic but from a slightly different angle. The research was conducted mostly in cooperation with product development professionals, departments and organizations, which is why the background and focus of the interviewees is strongly in products. Despite of, or owing to this, some important findings show that the understanding of the concept creation and concept management is not deep, not even today, and there is room for interdisciplinary and holistic approaches. The way of thinking in companies is too narrow, and the present work should assist companies and organizations in seeing a countless number of opportunities for innovations, and to better understand the business of today and future by means of concept creation and management.

3.2 Methodology and Data Collection

Data are collected during 2008 and 2015 in the EU-funded research and development project called ProtoProducts in the University of Lapland, also data from the Tekes-funded Bioact (University of Lapland) and Idearun projects (Aalto University) are used. Furthermore, separate sets of interviews have also been conducted. Bioact and Idearun were Tekes-funded projects (the Finnish Funding Agency for Innovation). This study includes six separate papers; three of the papers are based on interviews in 29 companies altogether, and three papers are based on case studies within ten (10) case companies and few product development student and researcher teams. As a summary, 39 companies are involved in this study. This study is also based on a literature review of the areas of design, development and innovation.

4 Results

This chapter reviews the main findings of this study. Based on interviews among Finnish companies and a literature review, a new approach called Concept Thinking is introduced (paper I). Based on a case study in food industry, a new model referred to as Levels of Concept Development is presented. These three levels of concept development are product level, service level and business level concept development (paper II). In Paper III, the idea of concept development is extended to cover innovations, named as Concept Innovation – the question is that is it possible to shape innovations as complex solutions on a conceptual level (paper III). Furthermore, an industrial B-to-B business angle is covered and a model of Collaborative Concept Development is drafted based on a survey among companies providing B-to-B services (paper IV). Further, Innovative Concept Development in the Food Industry is described as an example to concretize the idea of concept development in industry and to describe a more traditional R&D culture (paper V). Finally, an approach called Business Model Based Concept Generation is visualized and GoldMine Concept Lab, an environment for early phase concept creation and prototyping, is presented (paper VI).

4.1 Paper I: Concept Thinking

This research yields a new mindset referred to as Concept Thinking. It means that innovations and innovation potential in the entire business can be better understood when thinking through concepts. New concepts can be created by forming holistic packages, and in concept thinking, all parts of business will be taken into consideration. The factors leading to breakthrough solutions and innovation should not be limited only to product or service development but also the whole business model should be considered, including business and finance, organization and networking, and processes and production. In fact, concept thinking enhances the ability to see the bigger picture and makes it possible to question every part of business.

Concept thinking is seen here from the perspective of so-called Business Model Based Concept Creation. All businesses have the components showed in Figure 3, and most importantly, all these components can be realized innovatively. In

product and service development, it is beneficial to think about the new concepts by taking into account all these fields from the two by two table (Figure 3), because it forces one to think about the holistic picture and gives new perspectives to a development task. By understanding the entire concept, it is possible to achieve new innovative and groundbreaking solutions.

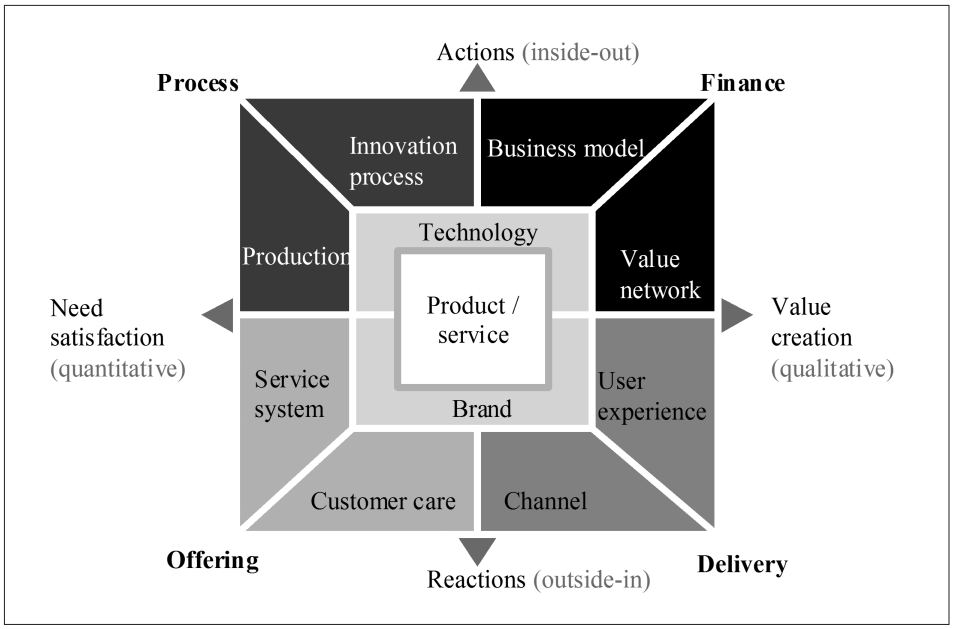

Figure 3 – Theoretical structure of a (business) concept

Based on interviews within fourteen manufacturing companies from various branches of industry, that the most successful companies have a sharp concept and high degree of specialization. Some of them also had a similar recipe for success: they had special raw materials and/or special manufacturing processes, and they had identified a narrow market niche to which they offered special products with low competition. Moreover, they had created a unique and authentic brand. We found that companies are growing by either multiplying something based on a specific concept or then they create new concepts.

This paper also argues that the role of Concept Thinking changes according to focus (Perttula and Sääskilahti, 2004; Sääskilahti et al., 2005). The more abstract a development task is, the more important the role of concept development becomes. In new business development and long-range planning, new concepts and concept thinking become indispensable because of the complex nature of the development activities. Emerging and visioning concept development requires a

high degree of concept thinking but less engineering. In new business development (NBD), new and emerging things are gathered together. We refer to this approach as emerging concept development. Visioning concept development is important when developing new concepts for studying and future-oriented decision-making purposes.

Moreover, engineering work dominates in product and service design but loses its significance when new businesses are developed. It means that defining and solving concept development activities are engineering driven and Concept Thinking is less important. When creating upgrades or line extensions, designers seek the most optimal solutions by developing competitive design concepts. There is often a need to solve problems innovatively when designing new products and services. We refer to this type of concept creation as solving concept development. In NPD/NSD, the aim of concept development is to draw a big picture of the development project to communicate and test the concept before it is developed further. A well-defined concept is the key to successful product and service development (Sääskilahti, 2010). We call this type of activity defining concept development.

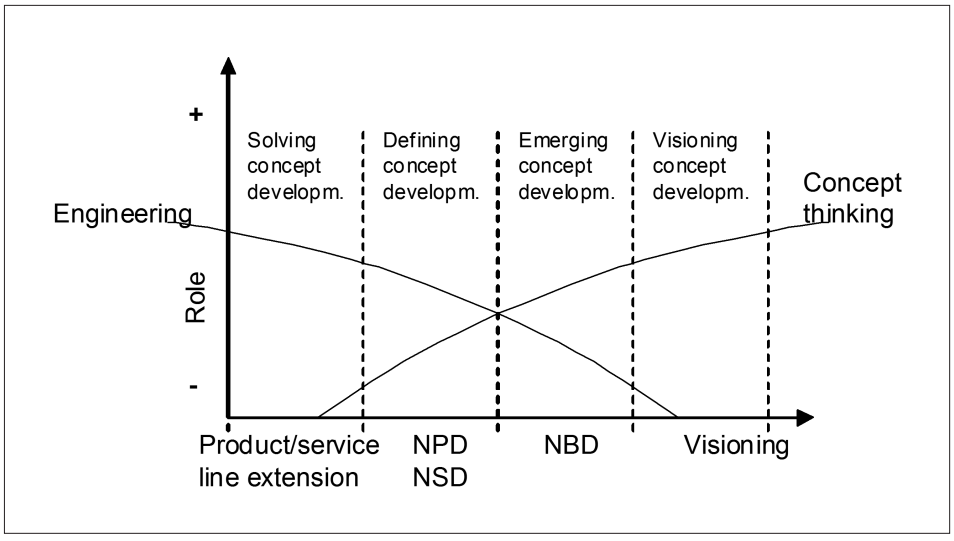

Figure 4 – The role of concept thinking

A comprehensive approach to the front end effectively links business strategy and innovation work. It is argued that systematic and conscious concept development can be seen as a tool to reduce fuzziness at the early stages of development (Alam, 2006; Perttula and Sääskilahti, 2004). For the future work, we claim that the holistic concept creation approach could be a cornerstone for an innovative

organization to be able to work as one team rather than separate development units. By carefully defining the concepts it is possible to communicate the tasks better and to proceed through the development process smoothly.

4.2 Paper II: Levels of Concept Development

Small- and micro-size companies often have poorly defined innovation processes and their development activities are not managed well. The front-end innovation phase (FEI) is not even identified as such. In addition to this, the focus of the development is usually on products, while service potential is easily neglected and new business opportunities are not constantly explored. Nevertheless, design and development activities should cover three levels, product level, service level and business level, according to this study. Levels of concept development are introduced in the referred paper.

This part of the research is based on observations and action research in six case companies operating in the Lappish food and hospitality business. Material is collected when participating in these particular product development projects. The company profiles were different compared to each other: there were two retail trade companies with their own meat processing facilities, one company offering tourism and restaurant services also with its own meat processing, one tourist shop including a processing line of berries, one tourist attraction with restaurant services, and one company processing vegetables for hotel, restaurant and catering use.

Three of the cases were pure product development cases and they seemed to be successful. The other three cases mixed both product, service and even new business development and they all failed because the entrepreneurs and developers were focusing only on products and not on the entire concept. The goal was too ambitious because of lack of experience and appropriate resources and knowledge. By analyzing these cases, a new tool for concept development and project planning was structured. With this tool, it is possible for managers to position new concepts created in the front-end phase and focus on purposeful results.

In the model introduced here, the main levels of concept development are product level, service level and business level concept development, see Figure 5. In the model, a new product is considered a starting point, and in addition to that, there are two dimensions, newness of a service and business, which should be taken into consideration when estimating the complexity of a concept and development task. Moreover, there are nine areas defined on the table – when a concept is really new to the company, it is presented as radical either on a business or service axis. In the middle of the axes, there are incremental choices. Furthermore, a new concept may be a combination of incremental and radical solutions, as the table shows. Six case companies (C1-C6) are placed on the table to describe the nature of and differences between the cases.

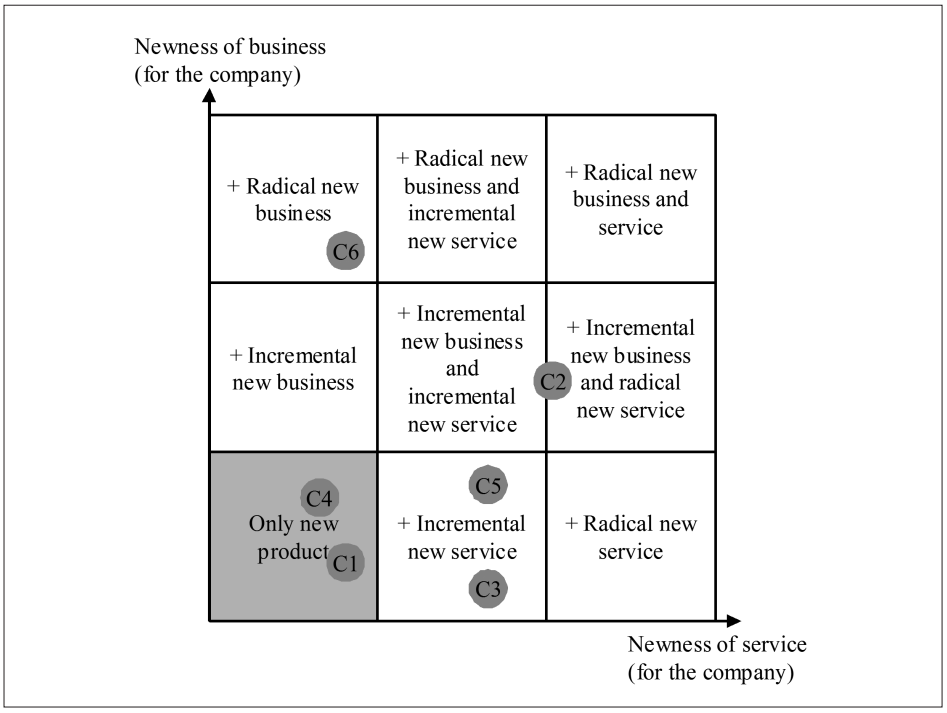

Figure 5 – Levels of concept development – a tool for concept development and project planning

Small- and micro-sized companies often have limited resources to develop technological solutions but they could have much potential in new business and service development. Companies could take a step towards new service and business development from the "origin" of product development instead of thinking e.g. of challenges in new technologies related to products and production. Due to findings of this study, the understanding of front-end innovation and especially

the concept development phase should be strengthened among entrepreneurs and developers in small companies so that they could more elaborately seek for innovative ways to grow not just as product sellers but also service providers.

4.3 Paper III: Concept Innovation – new approach for creating innovations at a conceptual level

The third part of the research focuses on finding ways for companies to be able to recognize the potential of innovations in the early phase of an innovation process; a new notion called Concept Innovation was developed. It is a vision of a potential innovation to be created. Innovation is understood as a new and creative solution leading to a commercial success. The aim was to render the process of creating, studying and testing innovations more visible and more manageable. Furthermore, it was analyzed whether the acceptance of different types of innovations could be estimated already at the conceptual level by means of innovation diffusion theory.

Innovations are here divided into four main areas: finance, process, offering and delivery innovations. Instead of focusing only on product and service development or on the development of single processes, such as manufacturing processes, the idea is to take the entire business into account. All these categories should be taken into account when developing concept innovations. The innovation described on a conceptual level enables demonstrating the potential state of the whole company in the future, if the new solutions reach the status of innovation. Furthermore, the concept innovations can be fed into the company's strategic decision-making processes, to nurture its creative and competitive capacities.

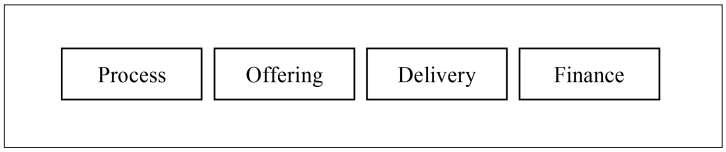

Figure 6 - Four areas where it is possible to create concept innovations.

Companies and organizations should be seen as a whole and as a system, which offers a countless number of opportunities for innovations. Due to this research, it is possible to systematically search for innovations with the aid of a certain concept phase in the very beginning of the process. In this paper, a technology-

push-type approach is introduced, explaining also how the related process could be accomplished in a more market-oriented way. Both viewpoints are critical for companies aiming at developing and managing a deep and holistic innovation process.

Conceptual paper and fiber products developed in the BioAct project were adopted as seed of technology-push-type innovations within the partner companies from forest, printing, chemical and paper industries. One finding was that this approach provides an opportunity to companies to estimate the business potential regarding new technologies and it takes into account the offering (products and services), but also includes the processes and delivery related to them. As a conclusion, even the technology-push-type approach may lead to business innovation if this particular framework (concept innovation) is in use.

Also the market-pull-type approach was drafted based on scenario-based methods (Sääskilahti et al.,2005). In this kind of approach, different future descriptions can be created with special scenario techniques, and then the concepts driven by new market need and potential can be placed on the predicted operational environments. This leads to concept innovations, which, as a matter of fact, may require any kind of technologies and may therefore be challenging. On the other hand, we came to the conclusion that it should be positive that a company is forced to adapt to new things and change (see Figure 7).

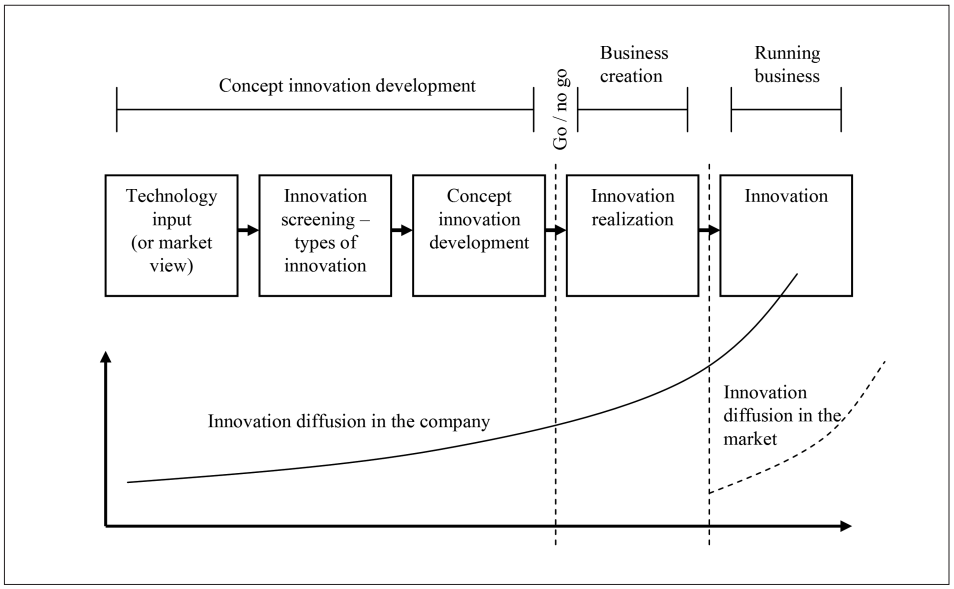

Figure 7 - Innovation development process and diffusion model

The paper related to this part of the study proposes that the idea of concept innovation leads to the assumption that also innovation diffusion in the company may start earlier, which should ease the change management and help the adaption of new solutions. In fact, the purpose is to make the profitability and relative advantage of potential innovations visible for the organization in the very early phases of the innovation process. Prior research has established that relative advantage, compatibility, trialability and observability are positively related to the speed of innovation adoption and complexity and perceived risk negatively related (Moore and Benbasat, 1991; Ostlund, 1974) P. Concept Innovation could therefore enhance diffusion of innovation in the companies.

4.4 Paper IV: Collaborative Concept Development in Creating B-to-B Service Innovations

Industrial services constitute a growing business within the manufacturing industry and often the larger profit and growth opportunity derives from services. However, companies still seem to have difficulties in achieving significant progress in service business (see e.g. Oliva and Kallenberg, 2003; Gebauer and Fleisch, 2007; Hyötyläinen, 2007; Salkari et al., 2007). A strong manufacturing-oriented way of conducting business, difficulties in integrating services into core product offering, and choosing a right service strategy seem to be the most important reasons for the difficulties in service business development (Brax, 2005; Auguste et al., 2006; Oliva and Kallenberg, 2003). The role of customers and the importance of the early stages of service innovation process are emphasized in the literature (Alam, 2006). Against this background, the idea of a re-organized concept development phase is introduced in this paper.

This study was based on interviews in six globally operating manufacturing and power production companies, with ten representatives interviewed. The aim was to understand the status of service development in Finnish production-based industry. As a result, we found that most of the companies have no process for service development and no service development methodologies are in use. As a matter of fact, the representatives of the companies were confused about how service development should be implemented. Most of the companies had never thought that services could be developed following a formal innovation process with the different phases also including a well-managed front-end innovation.

Only one large company had a service innovation team producing new and innovative service concepts that they presented to the management board in the way product developers typically do.

We placed companies in a two by two table (Figure 8) and found that their way of developing services differed considerably, reflecting organization cultural characteristics. We named the companies from the perspective of the development culture in the organization. Mastodon is a company operating on a global market and the need for innovations is not evident in a short run, but could still be critical in the long run. Servitization is, however, emphasized but they do not have a dedicated organizational development unit for that. Doer is an agile and smaller company, which operates in a strongly customer-oriented way in the sense that the wishes of the customer guide new product and service development. The company culture represents more actions related to problem solving than proactive innovation work. The third group is Technocrats with some technological advantage while new solutions guarantee that they maintain a cutting edge. The company we interviewed had some life-cycle services, but the service business was not well established. Last but not least comes Forerunner, which earns most of its profits from the service side, and they are actively developing new service concepts and their customers are also involved in the innovation process.

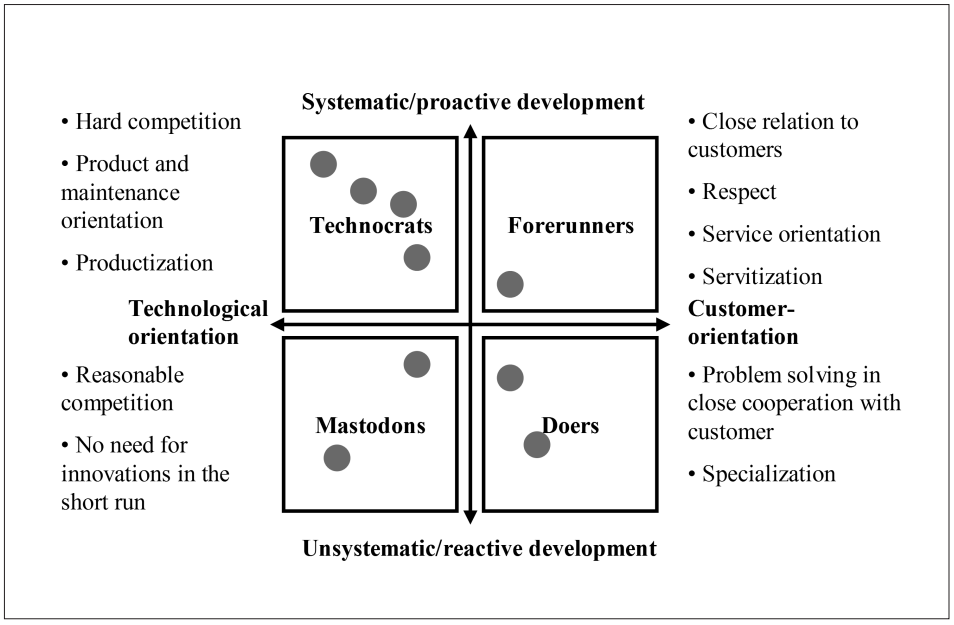

Figure 8 – Companies' ways of developing services

The interviews also revealed that the companies are product-oriented and their organizations are not ready for a perspective change from technology and tangible products to customer needs and intangible services. We also found that services are considered highly strategic. Therefore it is recommended that top management from both the provider and the customer should also participate in service concept development. This would strengthen the commonly agreed description of the relationship between customer and service provider processes and support organizational and network changes. Despite of this, we observed that companies are not ready without reservations for open conversations with their customers, and new ideas are even kept hidden by the developers. These are the reasons why the new concept development phase is shaped here.

We concluded with a hypothesis that the concept development phase should cover both products and services, to include the business model and business logic (see Figure 9). Also the customer should be involved in the concept creation process to gain success and to renew the development practices. The main challenge is clearly the shift from product-centric to a more customer- and service-oriented culture. Similarly, the possible boundaries between management, service and product development should be dissolved. A well-defined and communicated concept enables investment decisions after concept definition and eases therefore the following development and implementation phases.

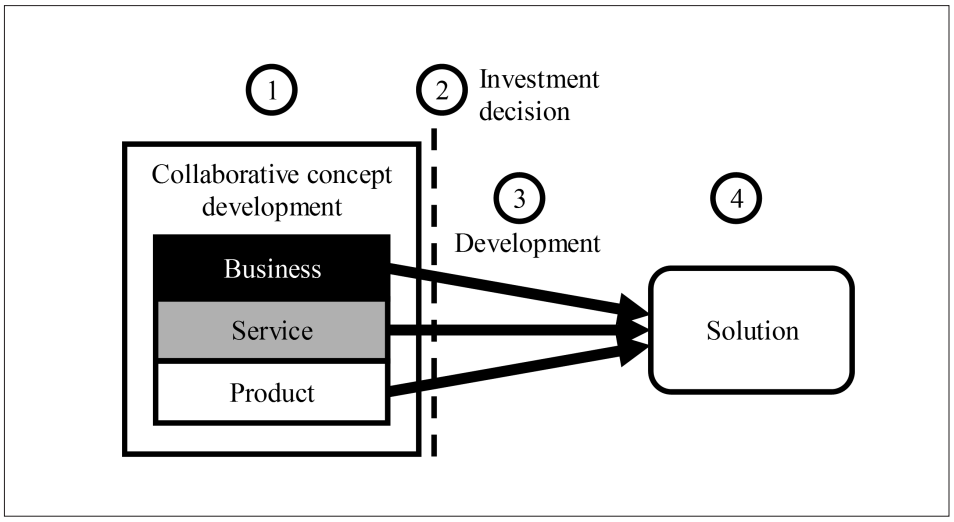

Figure 9 – Collaborative concept development

One important notion in this research was that products and services are generally developed separately. More precisely, the present trend is for physical products or machines to be developed first, and services only afterwards. This may prevent the creation of service innovations (Figure 10). There is an urgent need for both cultural and mind-set changes in the companies and also on the customer side the changes in the deep cultural assumptions as well as visible structures and processes need time and resources. Moreover, the change calls for proactive and visionary development actions requiring a combination of different innovation practices and management styles (Magnusson et al. 2009; Nuutinen and Lappalainen, 2009; Gebauer and Fleisch, 2007; Oliva and Kallenberg, 2003).

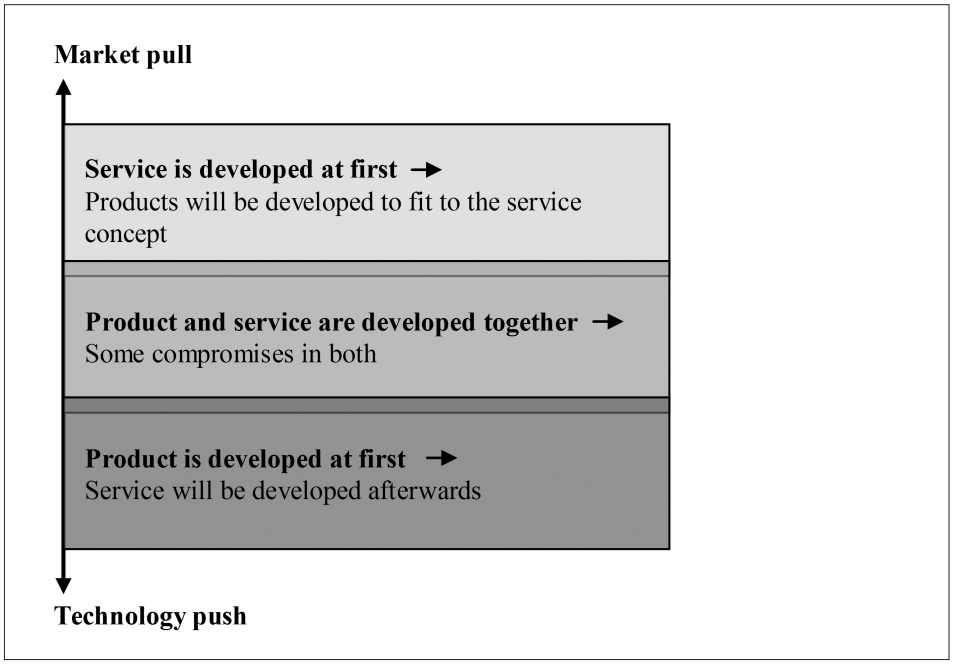

Figure 10 - Product orientation vs. service orientation

This paper also draft envisaged development tracks for the companies (see Figure 11). Each way of developing services has its own strengths and challenges. Mastodon's challenges were related to the activities in innovation work; they should pay attention to long-range visionary work. Doers could base their improvement measures on innovation methodology and practices, and also investments in technological skills and solutions could prove beneficial. Technocrats are technologically oriented and according to our model, they have new potential

in involving the customers and users in their development work. Also a cultural change is probably needed. Forerunners may have some borders inside the organization, which negatively affects the collaborative concept development.

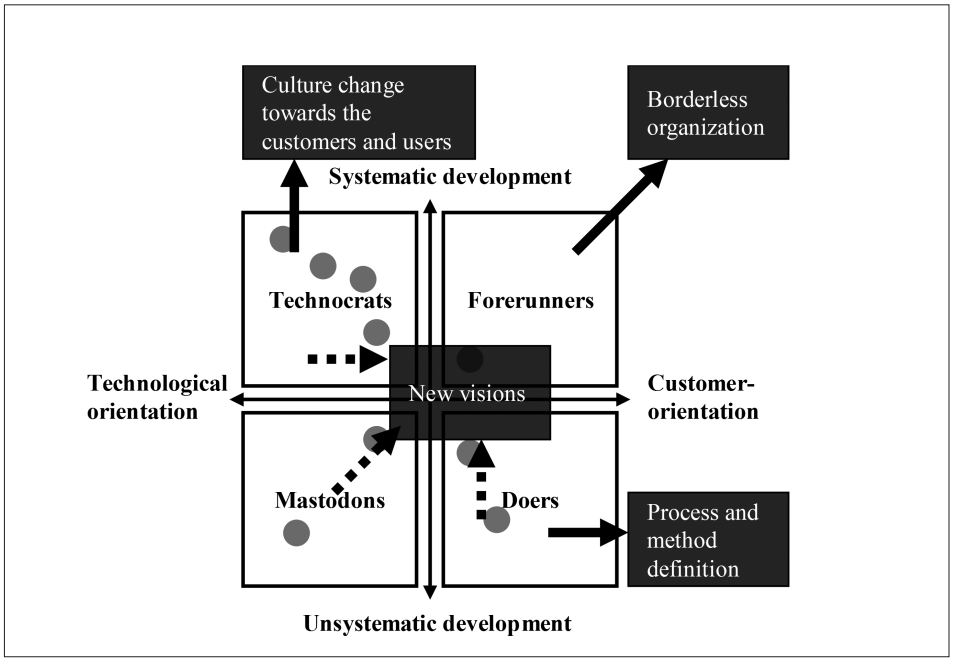

Figure 11 – Paths to change based on present strengths and weaknesses

As a conclusion, the overall concept, including the business model and processes, and intangible and tangible parts of the offerings, should be defined at the beginning of the development process, before the actual investment decision and before any further development and implementation. The organization should provide borderless platforms for innovation work, and key stakeholders such as customers and end-users, should be involved in front-end innovation. These are the characteristics of collaborative concept development. When aiming at significant growth in the service business, the service innovation process should be adopted and changes in the organizational structure and culture made.

4.5 Paper V: Innovative Concept Development in the Food Industry

In paper V, findings similar to Paper IV were produced in our research in the Finnish Lapland in the food sector – companies are missing a methodology and process to create holistic concepts. The companies within the food sector focus

on product innovations, although a great number of products fail; even most new products never spend a second year on the shelves (Lord, 2000). According to some studies, small companies' success rate is low: approximately one out of ten of their new products survive. Large companies succeed in more than half of their attempts (Lord, 2000). Our findings show that there is much potential in services and brand innovations. This means that developing new products is not the only means to gain new business. These notions made us figure out how also small companies could carry out successful projects.

We conducted a semi-structured interview within eight micro-, small- and medium-size food companies in Lapland. Also representatives of one big food company from Southern Finland were interviewed to enhance the understanding of development issues and innovation work generally. The aim of this study was to find out how the companies in the food sector run their research and development (R&D) activities, and what drives their development process. The goal was to find different recipes for success, allowing us to structure a classification table to characterize companies according to their development practices (see Figure 12).

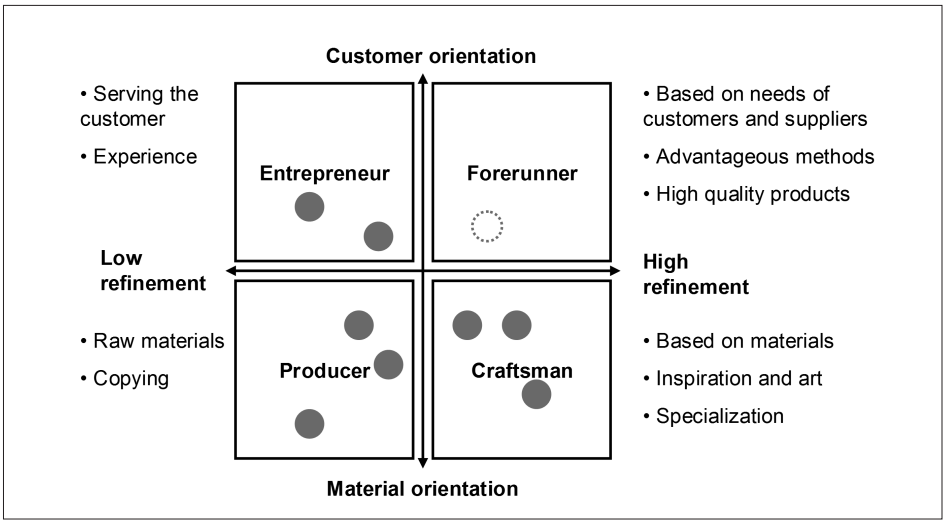

Figure 12 – Characterization and development guidelines of the companies interviewed

The two-by-two table is constructed similarly to the one presented in the previous paper but here the focus is on innovations while it was on cultural and methodological change in the previous one. In the table, the horizontal axis represents refinement and the vertical one customer versus material orientation.

These main perspectives were found when defining R&D activities in the researched companies. Again the companies were placed in the table and descriptive names were given; companies are called producers, craftsmen, entrepreneurs and forerunners. The names represent the public images of the companies.

Two reindeer farms and one medium-size meat refinery were referred to as producers. They were lacking their own product ideas and customer needs had practically not been identified. Products were raw-material based. Two bakeries and one natural product company were classified under craftsmen. Their products were based on special knowhow and materials, and also inspiration played a significant role in new product development. The products of these companies can be compared to those manufacturing and selling arts and crafts. Two companies delivering peeled vegetables and even some kitchen products for the restaurants were called entrepreneurs. Their business was based on customer needs rather than their own proactive innovation work. A large food manufacturing company outside of our main research focus was considered a forerunner. Their fluent productization process and customer-oriented approach was much more efficient than those in the smaller companies.

We found that the producer-type companies would need new knowhow in design and marketing to achieve a higher level of consumer food products. These companies were facing the traditional dilemma that for a greater volume they would need a stronger pull from the market and that, of course, happens only if the products are desirable enough. The Craftsman-type companies may not necessarily want to grow heavily and they also want to manage the development and fabrication of their products by themselves. However, everybody strives for more profitable business. These companies could focus on brand issues and customer experience, like some cheese and drink manufacturers have done, even the small ones. Entrepreneurs could design their services rather than their own products, because serving their clients is something they can do best. In addition, forerunners could become game changers by implementing business innovation models and redefining the field of competition. The possible future paths of these companies are illustrated in Figure 13.

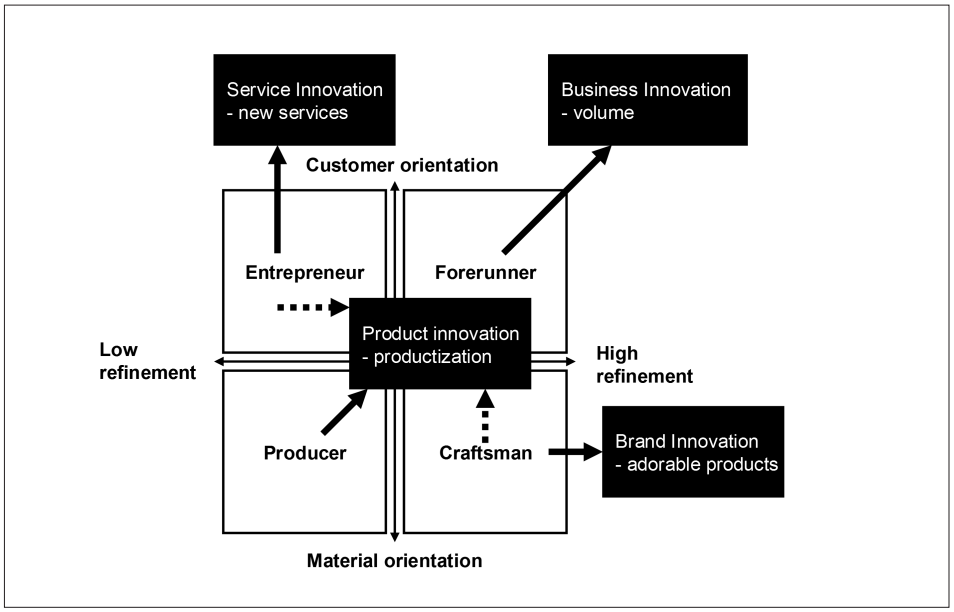

Figure 13 – Innovation concept examples

Food industry has huge potential in the field of innovations; most of the competitors are conservative terms of innovativeness, and on the other hand, consumer wants and needs are in a continuous change. As a matter of fact, peoples' lifestyle is changing as a whole, which opens new opportunities for new types of offerings and also e.g. partnering and cooperation. As discussed in previous papers, concept development plays an essential role in the innovation process generally. Within food industry, this should be considered carefully; many studies highlight the importance of skilled workforce, investment in know-how, external sources of information, and both technology and market orientation in the development of new food products (Avermaete et al., 2004; Borch and Forsman, 2000; Earle, 1997; Grunert et al., 1997). In addition, also contacts with similar firms are especially important for innovation (Diederen et al., 2002). All these factors can be taken into consideration with holistic concept creation.

4.6 Paper VI: GoldMine Concept Lab: An Environment for Early Phase Concept Creation and Prototyping

Digitalization, servitization, rapidly developing technologies and tight competition are shaping corporate offerings. In the development of product-service systems, concepts are often complex and include both tangible and intangible elements; new needs have emerged for idea selection, concept design, evaluation and testing.

One promising method for achieving these purposes is experience prototyping. Design thinking is a mind-set and a process to be utilized in problem solving in any field, most often in the context of product and service design. It consists of five stageso: empathize, define, ideate, prototype and test (Brown, 2008). This paper introduces an environment for early-phase concept creation and prototyping (GoldMine Concept Lab), and an approach called business model based concept creation. The GoldMine Concept Lab is designed to support the innovation team when proceeding through the design (thinking) process.

Visualization, prototyping and so-called serious play methods are important in design. The GoldMine Concept Lab supports designers and developers in visualizing, demonstrating, communicating and prototyping their tangible and intangible ideas. The GoldMine Concept Lab consists of four main elements: 1) Mobile screens, 2) Telepresence tools, 3) Concept Puzzle and 4) Workshop process. Mock-up materials and other props are provided, too. The screens offer three main functions: they enable a wide variety of visual material to be displayed simultaneously, background pictures and ambient sounds to be produced for experience prototyping sessions, and online videoconferences to be broadcasted. A telepresence robot makes it possible for external parties to participate in workshop action. Instead of a robot, generally any kind of telepresence tools can be used. Concept Puzzle (Figure 14) is a tool for "Business Model Based Concept Creation". Puzzle helps designers to see the big picture and take the entire business into consideration. The pieces of a Concept Puzzle include a profit model, brand, resources, value network, delivery, production, customer care, communication, technology, experience, intangible solution (service) or a tangible solution (product). Concept Puzzle is actually a physical puzzle in the concept lab, and it can be played during workshops. In the workshop process, four steps are used to define the preliminary concepts. The first step is to communicate the design brief, facts, benchmarking data, among others, simultaneously to perceive an overall image. The second step is to ideate as many ideas as possible. The third step is to experience ideas by prototyping and demonstrations, and then design further. The last step is to expand the idea with concept variants.

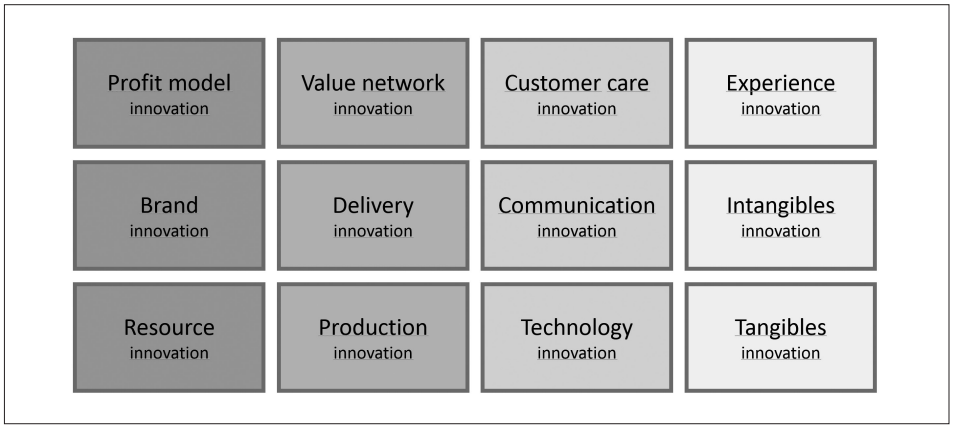

Figure 14 – A structure of Concept Puzzle, a tool for business model-based concept generation

Observation data were collected in three workshops organized in GoldMine. The focus was on the functionality of the concept lab: two student product-development teams were assigned the task of developing new concepts for navigation and sanitation, and one research team developed concepts for health care. The teams were interdisciplinary, while one student team (navigation) also included remote participants. Researchers acted as facilitators and observers during the workshops, which were held using GoldMine at Aalto University Design Factory during 2014 and 2015. The case study shows that experience prototyping offers a powerful method for idea selection, concept creation and concept evaluation; experience prototyping brought new angles to idea testing and selection: one team realized how great an influence for example changes in the profit model and delivery channel can have on their technical solution.

5 Discussion and conclusions

This chapter briefly summarizes the main findings of the study. Under managerial implications, new ideas related to concepts, concept thinking, concept creation, and concept management are elaborated, leading to suggestions for future research. Also the limitations of this study are discussed here.

5.1 Summary and Discussion of the results

The objective of this study was to find out how manufacturing companies accomplish the front-end innovation process (FEI), and what kinds of concepts are created. The research questions were formulated to examine how and what kind of concepts companies develop in the front end of the innovation process, and furthermore, to discuss how companies could enhance their performance in FEI. The theoretical background of this study is in the crossing of product development, design and innovation management literature.

The first paper introduces a new mindset referred to as Concept Thinking. New concepts can be created by designing holistic packages, and in concept thinking, all parts of business will be taken into consideration. Companies have innovation opportunities in product, service and business levels, as explained in the second paper. The focus is often still in new products and the full innovation potential of the companies is not used. In Paper III, a new notion called Concept Innovation is presented to empower the front-end innovation work. Papers IV and V, highlight the importance of borderless collaboration and newly define the concept development phase.

Concept development is traditionally seen as the most critical phase of a development process (e.g. Orihata and Watanabe, 2000), and systematic concept development is often seen as a tool to reduce the fuzziness of the early stages of development (e.g. Alam, 2006). According to the literature, the greatest success is achieved by organizations that take a holistic approach to the front end (Khurana and Rosenthal, 1998). Nevertheless, based on our interviews and the observations made mostly within the manufacturing industry, both B-to-B and B-to-C, it can be concluded that companies are extremely product centric and the full innovation

potential is not in use. E.g. the value of service business is understood, but the tools and practices are missing. Moreover, business model innovations are not even mentioned among research and development (R&D) staff.

In smaller companies, front-end innovation processes and work are not often well organized and structured. In larger companies, the product development process including the concept development phase, is usually carefully defined and managed, but at the same time it limits the possibilities to create innovations related to other functions and offerings of the company. So to say, wide-scale innovation activity does not really exist in that sense. Concept creation is seen as an early phase of the product development process, which is how it is described in product development literature. Holistic concept development combining the overall expertise inside the company and the network is not reality in today's business within the average Finnish manufacturing company.

This study contributes to front-end innovation, and also research on product and service design. The growing trend both in academia and industry is to benefit the innovativeness of interdisciplinary design teams, and in this context the concept creation mind-sets, methods and tools are essential. It is a question of both the focus and means of innovation work. In the following parts of this discussion chapter, the theoretical and managerial implications of the study are presented.

5.2 Theoretical Contribution

The aim of this study is to produce practical value for designers, innovators and managers, but also to take theoretical viewpoints into account. New ideas of holistic concept creation were reflected against traditional product development theory and innovation and marketing management theories. This study is related to both design and business research by its nature.

Front-End Innovation (FEI), often called Fuzzy Front-End (FFE), is studied in all the mentioned fields: product development and product innovation, e.g. Khurana and Rosenthal (1998), marketing, e.g. Alam (2006), innovation management, e.g. Kim and Wilemon (2002). Concept creation as a research topic links all these areas together in practice and theory. In product development theory, products are naturally placed centre-stage in concept creation, while marketing theories

bring services under the scope (e.g. Gebauer and Friedli, 2005 and 2007). In the theories of innovation management, the strategic importance of FEI is highlighted (e.g. Kim and Wilemon, 2002).

The holistic innovation approach is implemented in companies in various ways. The most popular innovation tools are called "The Fantastic Four" (http://torgronsund.com/2013/07/04/innovation-tools/, October 28th, 2014), which are Blue Ocean Strategy (Kim and Mauborgne, 2005), Disruptive Innovation (Christensen, 1997), Lean Startup (Ries, 2011) and Business Model Canvas (Osterwalder and Pigneur, 2010). Also Ten Types of Innovation is a tool for building breakthroughs (Keeley et al., 2013). These tools focus on the entire business model in terms of innovation work. In addition, they form a great theoretical background for holistic concept creation. We can call this "Business Model Based Concept Creation", where new concepts (including concepts of new products and services) are developed taking the whole business into consideration.

This study is also linked to innovation diffusion theory (Rogers, 2003). The idea of Concept Innovation presented here leads to the assumption that also innovation diffusion in the company might start earlier, which should ease the change management and help the adoption of new solutions. As presented in Paper III, Concept Innovation, the purpose is to make the potential innovations visible for the organization in very early phases of the innovation process.

The main theoretical contribution of this study is that it shows that a strong product development background prevents holistic front-end activity, and R&D oriented towards product development does not foster the emergence and growth of other types of innovations. Products are seen as innovations themselves, not as a part of more extensive innovations. We can call this a burden of product development history, both in practice and theory. The study also shows that different disciplines (e.g. R&D, marketing, management) are still operating in silos, which means that the borders between the disciplines exist in front-end innovation. The dimensions of the concept creation phase should be redefined among development practices and literature; interdisciplinary and collaborative concept creation aiming at holistic solutions is the key when linking all the disciplines together.

5.3 Managerial Implications

The point of this study is to underline the importance of the holistic front-end phase, thus enabling innovations in a wide range. After the front-end phase, different disciplines may follow their own (simultaneous and co-creative) processes. A new product is often seen as a solution to conduct more successful business, although there would be other possibilities, even easier, faster and more powerful, to grow revenue and scale up the business. However, if most of the development activities in the company are tied to the product development process and methods, it is difficult to shift to other types of innovations (e.g. process, delivery and finance).

An approach called Business Model Based Concept Generation was introduced in Paper VI, meaning that concepts should be regarded as holistic packages and the whole business should be taken into consideration. In addition to this, Concept Thinking, introduced in Paper I also encourages developing concepts of anything, i.e. a concept of a new technical solution, concept of a service, concept of an event, concept of a successful team or concept of a new business model. Concepts shape the world around us, so to say. When a concept of something is understood and shaped, then it is possible to consciously develop it.

Furthermore, it is also possible to multiply something following its concept; an event can be arranged every year based on the same concept, a product or service can be multiplied time after time according to its concept, a restaurant can be multiplied and a restaurant chain formed under the guidance of the concept. Actually it is a question of how small and simple or large and complex the entities to be replicated are, from features and solutions to businesses and cultures, and how many times. Basically this is about scaling up the business, and a decision should be made what to replicate and how many times (Sutton and Rao, 2014).

In developing and managing the concepts, also the time dimension should be considered. There are concepts on three levels: concepts of a current business, concepts of new things in the innovation funnel, and concepts of the future things on the roadmap (see Figure 1). A concept is always a theoretical image of something, an explanation of a thing. It makes no difference if that thing is

something that exists, or whether it is on a drawing board or in a wild vision; the concept always explains it similarly. When perceiving the concept, it is possible to communicate, develop, vary, scale, replicate or even "kill" that thing.

It is important to understand what kinds of concepts the company or other actors have at the moment. For example, products and product families have certain underlying concepts, and so do services. Also, there are concepts behind all the other solutions and systems, working methods, teams, processes, production, campaigns etc. From the managerial point of view, it is important to visualize and understand these existing concepts, so that it is possible to consciously scale the business. Some of the concepts are more innovative than the others, so it is essential to also identify the innovativeness of the concepts. The concept portfolio and concept management should be considered.

In the innovation funnel or process there are new things emerging – there is a certain concept behind all these new things. This concept is usually developed in a certain phase (concept phase) in the front-end of innovation process (FEI). Typically it is a concept of a product or a service, or a product-service-system. But it could be something else too, like the concept of a joint venture or new delivery method, if open-minded concept creation is implemented. When the thing is under the development, it can be communicated and demonstrated e.g. by charts, texts, visualizations, models, mock-ups, prototypes. When the thing is ready and for example launched, the same concept developed earlier can still be found behind it. Moreover, there can be concepts of future items on the road map. These concepts of future things can later be dropped to the innovation funnel and finally these things will be a part of the ongoing business. And again, the designed concept can be found behind this thing.

The main managerial implications are that (manufacturing) companies have access to a great variety of innovations, if they can avoid product centeredness and the technology-push-type of approach. Moreover, conscious concept development and concept management might be the key to successful front-end innovation and innovative growth. Concept creation should be seen as an important possibility to collaborate with the company or organization members

and other important stakeholders, bringing the interdisciplinary knowledge into the innovation process. Product and service design should be adjusted to more holistic concepts, where the entire business model is considered.

5.4 Limitations

The limitations of this study are related to the case study methodology and data gathered by diverse interviews. Also the ideas and hypotheses regarding holistic concept creation methodology presented by researchers are not validated by other studies, which decreases the reliability of these recommendations. This study is also in the crossroads of product development, marketing and innovation management disciplines, making the theoretical background weaker and messier.

This study includes five separate papers; three of the papers are based on interviews made in 29 companies altogether, and two papers are based on case studies and action research within ten (10) case companies. As a summary, 39 companies are involved in this study. Interviews were mostly semi-structured, but the data collected here is heterogeneous as a whole. This limits the interpretation of the data. The individuals representing the companies were mostly from R&D or, on the other hand, entrepreneurs, and no other groups of professions were interviewed in the companies. It is not clarified here how front-end innovation looks like from the point of view of the rest of the employees in the companies.

The researchers were participating in the projects of the case study companies as actors, which decreases the objectivity of the research related to two of the papers in this study. Also Lapland as a region that was used empirically in three of these papers is special in the sense that it is located in a peripheral region of Finland and the EU. Companies were micro- or small-size, which may limit the generalizability of the results. On the other hand, most of the companies in most of the countries are micro- or small-size, and they are often located in peripheral locations. Actually, similar results were gathered both in small companies in Lapland and in large corporations in Southern Finland. Still it is possible that the results would have been different if the interviews had been conducted only within the companies implementing the cutting-edge innovation practices.

5.5 Further Research

A deeper case study in one manufacturing company could be conducted to verify the results of this study. The expectations for concept creation could be measured in different units in the company. Implementation of Concept Thinking and holistic front-end activities would bring new information to this topic. It would be fruitful to involve participants from every discipline of the company and its network in the concept creation, and to see if significant outputs would emerge. Also the concept portfolio could be visualized to see if concept management would bring added value to the management of a business and, on the other hand, to design operations.

Another natural path for future research would be, from the product development and design point of view, to see what kind of influence the holistic concept creation would cause; how design drivers would be formed when building an extensive and more complex innovation. For example, when aiming at business model innovation, how should the product development process be adjusted? How should the concept be communicated to every party, and how should the simultaneous and integrated development work be actually achieved?

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